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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,131	01/02/2002	Eleanor P. Rabadam	ITL.0685US (P13044)	1085
	7590	11/06/2003	EXAMINER	
Timothy N. Trop TROP, PRUNER & HU, P.C. 8554 KATY FWY, STE 100 HOUSTON, TX 77024-1805			VIGUSHIN, JOHN B	
			ART UNIT	PAPER NUMBER
			2827	

DATE MAILED: 11/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/039,131	RABADAM ET AL.	
	Examiner	Art Unit	
	John B. Vigushin	2827	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 July 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12 and 14-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-9 and 17-23 is/are allowed.
- 6) ☒ Claim(s) 10-12, 14-16 and 24-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All   b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other:  |

### DETAILED ACTION

1. The present Office Action is responsive to Applicant's Amendment filed July 07, 2003 (Certificate of Mailing date: July 02, 2003). The Examiner acknowledges the amendments to Claims 10 and 24. Claims 1-28 remain pending in the instant amended Application.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 12, 14 and 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 12 recites the limitation "said adhesive attachment." There is insufficient antecedent basis for this limitation in the claim. Of the component to the substrate? Of the IC die to the substrate?

Claim 14 recites the limitation "wherein said component is a capacitor." However, "said component" has already been established in base Claim 10 as "a passive component in the form of an inductor." "[S]aid component" cannot possibly be structured such that it is **simultaneously** "a capacitor" **and** "an inductor" as claimed in Claim 14.

Claim 26 recites "including solder paste to attach said component." "[A]ttach said component" to what: to the substrate? to the die?

**Rejections Based On Prior Art**

4. The following references were relied upon for the rejections hereinbelow:

Harada et al. (US 6,512,680 B2)\*                      Kozono (US 2003/0038366 A1)

Lin et al. (US 5,239,198)\*                      Bell et al. (US 6,229,385 B1)

Juskey et al. (US 6,356,453 B1)

\*Previously made of record in the instant Application.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 10-12, 14-16 and 24-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harada et al. in view of Lin et al., Juskey et al., Kozono and Bell et al.

A) As to Claims 10 and 24:

I. Harada et al. discloses, in Fig. 11: a package comprising: a substrate 140; an IC die 120 mounted on substrate 140 (col.8: 5-11); a BGA with multiple solder balls attached to a bottom surface of substrate 140 (col.8: 12-15); a charge pump including a passive component 112, 113 and electrically coupled to die 120 through substrate 140 (Fig. 11; col.2: 43-49).

II. Harada et al. does not teach: 1) a region of the bottom surface of substrate 140 free of the solder balls, 2) the passive component 112, 113 in the form of an

inductor and mounted on the region, and 3) the extension of the component 112, 113 from the bottom surface of the substrate is less than or equal to the extension of the solder balls from the bottom surface of the substrate.

IIIa. Lin et al. discloses, in Fig. 7: a package 52 comprising: a substrate 12; an IC die 20 mounted on substrate 12; a BGA with multiple solder balls 32 attached to a bottom surface of substrate 12, the bottom surface including a region free of solder balls 32; a passive component 50 mounted on the region and electrically coupled to die 20 through traces 16, vias 18 and traces 14 of substrate 12 (col.6: 61-64; col.1: 46-52), wherein the extension of the passive component 50 is less than the extension of the balls 32 from the bottom surface of substrate 12 in order to be spaced from the motherboard 38. Lin et al. teaches that having components on two different levels (i.e., opposite sides) of the substrate enables the fabrication of a device having its dimensions or "footprint" as small as possible, which is demanded by the consumer electronics industry (col.8: 41-50; col.1: 26-35).

IIIb. Since both Harada et al. and Lin et al. are both practitioners in the same art of electronics packaging, the reduction of package dimensions for the purpose of making smaller consumer electronic devices, as taught by Lin et al., would have been readily recognized in the pertinent art of Harada et al.

IIIc. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the BGA on the bottom surface the substrate of Harada et al. by including a region free of solder balls, and mounting in said free region the passive components 112, 113 of the charge pump so that they extend from

the substrate less than the extension of the solder balls of the BGA, in order that the passive components are safely spaced from the motherboard 122 as taught in Lin et al., and in order to form a compact package structure in Harada et al. that enables the fabrication of smaller electronic packages as desired in the electronics industry, as taught by Lin et al.

IVa. Harada et al. teaches that the passive component 112 or 113 of the charge pump circuit is a capacitor (col.2: 43-49); and the modifying reference of Lin et al., teaches *any* passive component 50 (e.g., a resistor, diode, capacitor, "*or the like*") that can be surface mounted through solder joints 51 to the substrate 12 (Fig. 7; col.6: 61-64). Furthermore, Juskey et al. discloses a passive component similar to the passive component of Lin et al., and in particular, an inductor 532 (Figs. 5 and 7) that, as in Lin et al., is surface mounted through solder joints 534 (formed by use of solder paste) to the substrate 512 (col.12: 12-32), and Kozono (Fig. 28 and p.7, paragraph [0073]) teaches a package structure similar to that of Lin et al. wherein the passive component (i.e., inductor 709 in Fig. 28) is taught as part of a DC/DC converter that, as in the Lin et al. package, is also mounted on the ball-free region of the substrate. Finally, Bell et al. discloses (see col.1: 17-37) that DC/DC converters, such as charge pump type DC/DC converters, can be implemented using inductor-based topology (such as the DC/DC converter taught by Kozono) or capacitor-based topology, each topology having its own advantages and disadvantages to be taken in consideration for a particular electronic system application and therefore, the inductor-based DC/DC converter of Kozono,

modified as the charge pump type inductor-based DC/DC converter of Bell et al., is old and well-known in the art for boosting the voltage in an electronic system.

IVb. Accordingly, in view of IVa, above, it would have been obvious to one of ordinary skill in the art at the time the invention was made for the passive component 50--surface mounted to the ball-free region of the substrate through solder joints 51--in Lin et al., to be the similarly surface-mounted inductor 532 through solder joints 534 (formed by reflow of solder paste) of Juskey et al., and included in an inductor-based DC/DC converter, as taught by Kozono, and in particular, the inductor-based charge pump type DC/DC converter taught by Bell et al., for boosting the voltage in the electronic system in which the package is applied.

B) As to Claims 11 and 25, modified Harada et al. further discloses the passive component 112 or 113 (modified as an inductor by Kozono and Bell et al.) is surface mounted (Harada et al., Fig. 12) as do the modifications of Harada et al. by Lin et al. (component 50 in Fig. 7) and Juskey et al. (Figs. 5 and 7), as established above in IIIa,b,c, IVa and IVb.

C) As to Claims 12 and 26 (as best understood by the Examiner in view of the 35 USC § 112, 2<sup>nd</sup> paragraph rejection of Claims 12 and 26 set forth in section 3, above), Harada et al. as modified by Lin et al. and Juskey et al. discloses that the adhesive attachment to the substrate of the passive component (i.e., the inductor) is solder paste (Lin et al., col.6: 61-64; Juskey et al., col.12: 12-32), as established in IVa and IVb, above.

D) As to Claim 14 (as best understood by the Examiner in view of the 35 USC § 112, 2<sup>nd</sup> paragraph rejection of Claim 14 set forth in section 3, above), modified Harada et al. further discloses that component 112 (and 113) is a capacitor (col.2: 43-45) (as does the package of Lin et al., in Fig. 7 and col.6: 61-64, which modifies Harada et al., as established above in IIIa,b,c).

E) As to Claims 15 and 27, modified Harada et al. further discloses that the package is a molded array package (col.8: 5-7) (as does Lin et al. in Fig. 7 and col.3: 67-col.4: 11).

F) As to Claims 16 and 28, modified Harada et al. further discloses the package uses Power Supply in Package technology (i.e., the capacitors 112, 113 of the charge pump are discrete components and mounted on the package substrate 122, as modified, above, by Fig. 7 of Lin et al.). Moreover, the inductor-based charge pump DC/DC converter in the teachings of Kozono and Bell et al. that further modify Harada et al., as established in IVa and IVb, above, also use Power Supply in Package technology (see Kozono, Fig. 28 and p.7, last four lines of paragraph [0073]).

7. Claims 10, 11, 15, 16, 24, 25, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozono in view of Bell et al.

As to Claims 10 and 24:

I. Kozono discloses, in Fig. 28, a substrate 710, an IC die 730 mounted on substrate 710; a ball grid array with multiple solder balls 704 attached to substrate 710, the substrate 710 including a region free of balls 704; a DC/DC converter including a passive component in the form of an inductor 709 mounted on said region and



electrically coupled to die 730, wherein the extension of component 709 from substrate 710 is less than or equal to the extension of balls 704 from substrate 710.

II. Kozono does not specify the type of DC/DC converter that includes a passive component in the form of an inductor.

III. Bell et al. discloses that DC/DC converters, such as charge pumps, can be implemented using inductor-based topology or capacitor-based topology, each having its own advantages and disadvantages to be taken in consideration for a particular application (col.1: 17-37).

IV. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to adapt the inductor-based DC/DC converter of Kozono for use as a charge pump type of DC/DC converter, as taught by Bell et al., in applications requiring the use of the inductor-based DC/DC converter of Kozono for boosting the voltage.

As to Claims 11 and 25, modified Kozono further discloses component 709 is surface-mounted to substrate 710 (Fig. 28).

As to Claims 15 and 27, modified Kozono further discloses that the package is a molded array package (Fig. 28; p.6, lines 9-10 of paragraph [0070]).

As to Claims 16 and 28, modified Kozono further discloses that the package uses Power Supply in Package technology (p.7, last four lines of paragraph [0073]).

***Allowable Subject Matter***

8. Claims 1-9 and 17-23 have been allowed.

9. The following is a statement of reasons for the indication of allowable subject matter:

In Claims 1-9 and 17-23, patentability resides in the limitation wherein *the extension of the passive component from the die is less than or equal to 16 mils*, in combination with the other limitations of base Claims 1 and 17, respectively.

10. As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

#### ***Response to Arguments***

11. Applicant's arguments (see p.6 of Applicant's instant Amendment, filed July 07, 2003) with respect to Claims 1 and 17 have been fully considered and are persuasive. The rejection of Claims 1-9 and 17-23 has been withdrawn.

12. Claims 10 and 24 were amended to call for "a passive component in the form of an inductor" responsive to the Examiner's indication of the above-recited limitation as allowable subject matter in the previous Office Action of April 22, 2003. However, an updated search and reconsideration of said limitation has resulted in a withdrawal of the indication of allowability and a new grounds of rejection of Claims 10-12, 14-16 and 24-28. Accordingly, the present Office Action has been made NON-FINAL.

### ***Conclusion***

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sander (US 6,522,192 B1) discloses a charge pump (boost doubler circuit) including both a capacitor and inductor in the structure of the charge pump circuit, wherein the inductor further regulates the boost effect; i.e., provides further voltage boost (Fig. 4; Abstract and col.2: 65-col.3: 5).

Zimlich (US 6,538,494 B2) discloses a charge pump which is suitable for operation in high speed and/or low powered semiconductor devices (such as a DRAM) wherein an inductor-based charge pump may be operated at higher frequency than the traditional capacitor-based charge pump (col.2: 29-60).

Björkengren (US 5,939,866) discloses a DC/DC converter (charge pump 400) that is capacitor-based (col.5: 24-60) and a DC/DC converter (charge pump 500) that is inductor-based (col.5: 61-col.6: 33) as art-equivalent charge pump embodiments.

Filipovski (US 6,348,818 B1) discloses a capacitor-based charge pump circuit which uses inductors instead of diodes in the voltage boosting circuitry in order to provide a greater increase in output voltage, and with greater efficiency, than the prior-art capacitor-based charge pumps with diodes (Fig. 1A; col.2: 58-64).

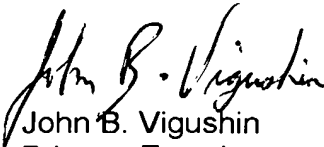
Gulczynski (US 4,803,610) discloses an inductor-based DC/DC boost converter, i.e., charge pump (col.2: 40-49).

Malinowski et al. (US 2003/0089979 A1) discloses a *non-semiconductor* chip (e.g., a chip comprising a circuit containing, *inter alia*, capacitors, inductors, and/or resistors) extending from a ball-free region of semiconductor IC chip 100 (Fig. 2 and p.3: paragraphs [0041] and [0042]) but does not teach the distance of the extension.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to John B. Vigushin whose telephone number is 703-308-1205. The examiner can normally be reached on 8:30AM-5:00PM Mo-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo can be reached on 703-308-1233. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
John B. Vigushin  
Primary Examiner  
Art Unit 2827

jbv  
October 17, 2003